

Course edition	1	Academic Year	2023-24
Ref.	MBUILD M31		
MODULE	SUSTAINABLE INFRASTRUCTURES AND CIRCULAR ECONOMY		
ECTS	6		
Year/Semester	Y2/S1		
Class hours	60h		
Teaching location	UC, Santander, Spain		

1. OBJECTIVES

- The main goal of this module is that the student learns the relevance of Sustainability of Infrastructures along their useful life, not only during design and construction, but also during the exploitation period.
- The students will learn the main aspects related to infrastructures maintenance and exploitation.
- Besides, they will learn the importance of applying environmental rating systems during the design and construction, in order to get the optimum cycle of circular economy. Finally, the students will learn the aspect related to sustainable mobility in cities, what will ensure their more rational use.

2. LEARNING OUTCOMES AND COMPETENCES

Learning outcomes

- To understand the importance of maintenance in the management of infrastructures (IS), in view of Circular Economy (CE).
- To learn the different types of preventive or corrective maintenance (P/CM). To be able to develop a planning of IS maintenance activities. Learn the different types of P/CM and be able to plan its tasks.
- To be able to identify the most common pathologies and failures and to know the different technologies for the maintenance of roads and urban IS
- Understand the importance of carrying out an environmental rating system (ERS) into a company, in view of CE.
- Be familiar with the general concepts of the most common ERS: CEEQUAL, LEED, ENVISION, SIRSDEC, Etc.
- To understand the mobility needs of citizens and the role of transport planning in IS planning and managing systems.
- To learn the most common sustainable mobility policies and traffic management measures.
- To know how Intelligent Transport Systems (ITS) work and their benefits.

Specific competences:

- Being able to sustainably manage the maintenance and operation of urban infrastructures..

3. SYLLABUS/TOPICS

Block 1 (15h). Daniel Castro:

Unit 1. Sustainable maintenance and rehabilitation of infrastructures.

- General concepts. Importance of maintenance and Circular Economy.
- Infrastructure Management Framework
- The most common pathologies and the different technologies for their maintenance.
- The preventive and corrective activities of maintenance.

- Visit to the facilities of the road maintenance center and the tunnel control center.

Block 2 (30h). Luigi Dell Olio & Borja Alonso Oreña:

Unit 2. Urban mobility:

- Introduction.
- Sustainable Mobility and Transport modelling approaches: Demand models
- Intelligent Transport Systems and New mobility trends
- Traffic management and transport policies: towards sustainability
- Workshop on mobility impact assessment
 - Introduction to Aimsun simulation tool
 - Network coding and demand data sources
 - Outputs & Results visualization
 - Case study analysis and Scenarios

Block 3 (15h): Joaquin Diaz & Christian Karl Baier

Unit 3. Environmental rating systems.

- Introduction, General concepts. The Circular economy and the Environmental Rating Systems.
- Main aspects to take into account for their implementation in a company.
- General characteristics of the most common environmental rating systems, e.g. CEEQUAL, LEED, ENVISION, SIRSDEC, Etc. Case studies.
- General Concepts and competitive similarities of sustainable evaluation systems.
- Implementing sustainable goals into BIM.
- Modell checking and evaluation of those properties.

4. MANDATORY REFERENCES

- Class notes provided by the lecturers

5. ADDITIONAL REFERENCES

- An Interdependent Infrastructure Asset Management Framework for Public Facilities. Chen Zhong · 2017.
- Public Infrastructure Management. Tracking Assets and Increasing System Resiliency. Frederick Bloetscher, 2019. Public Infrastructure Asset Management, Second Edition. Waheed Uddin, W. Ronald Hudson, Ralph C. G. Haas, 2013. Data Infrastructure Management. Insights and Strategies. Greg Schulz, 2019.
- Adams, K; Hobbs, G (2017). Material Resource Efficiency in Construction: Supporting a circular economy. Webster, K (2017). The Circular Economy: A Wealth of Flows.
- Lacy, P; Rutqvist, J (2015). Waste to Wealth: The Circular Economy Advantage.
- Cole RJ (2005) Building environmental assessment methods: redefining intentions and roles. Build Res Inf 35(5):455–467
- Ortuzar, J. de D. & Willumsen, L. G. Modelling Transport, 4th ed. Wiley. 2011.
- OECD Managing Urban Traffic Congestion. ECMT, 2007.

6. ASSESSMENT TYPE

- Continuous assessment at class, courseworks and activities developed during the semester. Also, an exam will be carried out during the teaching weeks.

7. ASSESSMENT COMPONENTS AND CALCULATION OF FINAL GRADE

7.1. Normal assessment (two opportunities)

The module will be assessed by:

- 25% Written Exam.
- 15% Activity evaluation with Virtual Media
- 50% Practical Exercises (Workshops) to be developed during the teaching period. Some of them will be in groups, some of them individuals. Details will be defined by each lecturer.
- 10% Continuous classroom evaluation (e.g., Class Notes). Individual evaluation. Details will be defined by each lecturer.

	Nr	Weigh in the final grade	Minimum grade
Block 1: weeks 1	1-10	25%	4.0 (0-10 UC scale)
Block 2: week 2&3	1-10	50%	3.0 (0-10 UC scale)
Block 3: week 4	1-10	25%	3.0 (0-10 UC scale)
		100%	5.0 (0-10 UC scale)
			10.0 (0-20 UP scale)
			50.0 (0-100 THM scale)

7.2. Resit assessment

- If the final grade of the module is FAILED, then the student has to resubmit the failed parts and/or retake the exam in order to increase the final grade of the module to obtain a PASS. In those cases

where the original exercise/workshop was submitted in group or in pairs, the new submission will be carried out individually; in those situations, lecturer will adapt the exercise to accommodate the working effort for an individual submission.

- Deadline of the re-submission or resit exam will be done, as latest, during the official resit period of the semester at UC.

8. TEACHING STAFF

Name	Position	University	email
Daniel Castro	Full Professor	UC	castrod@unican.es
Luigi dell'Olio	Full Professor	UC	delloliol@unican.es
Borja Alonso	Associate Professor	UC	alonsobo@unican.es
Joaquín Díaz	Professor	THM	Diaz@bau.thm.de
Kerstin Lenz	Researcher	THM	Kerstin.lemz@bau.thm.de
Christian Baier	Associate Professor	THM	Baier@bau.thm.de